

distributions. The difference between the counties' adjusted rates is then due to factors—biological fertility, prenatal care, birth control practices, etc.—other than age. For a second example, suppose the crude death rate in one county is higher than that in a second county, and suppose we ask if something other than race contributes to the difference. We would adjust the death rates for race. Any significant difference between the adjusted rates would then be due to factors other than race.

Plainly stated, the issue in rate adjustment is that of getting an unclouded view of the risk of an event within a study population. The crude rate may not help because it is influenced by the very clouds we would like to remove. In typical applications we must compare several small populations and decide issues which affect the health of our citizens. In these decisions our view of reality must be as clear as possible. If we have reason to place little confidence in the relative magnitudes of crude rates, then we must place our confidence elsewhere, for example in adjusted rates. A rate adjustment is a calculation of a rate which accounts for, and removes, potentially misleading effects caused by the structure of the study population.

Direct Adjustment

What is the direct method? In the direct method the crude rate becomes adjusted in the sense that it is recalculated by a kind of hybrid process which uses, from the study population, rates specific to categories (or strata) and, from a standard population, sizes of the corresponding categories. For each small study population we apply the category-specific rates to the category sizes of a single standard population. The diverse internal rates of the study populations then act under the common conditions of the standard population.

How does one choose the categories and the standard population? The appropriate categories in a particular application depend on which aspects—age, race, income, place of birth, education, etc.—of a study population are thought to be peculiar. Suppose Example 1 were part of a study of a specific cause of death across various age subsets of a population. The three age categories, (A), (B), and (C), show striking risk differences. (In an actual application we would be comparing this study population with another, and we would want to see if factors other than age contributed to differences between the two.) Age subsets would be appropriate categories, and we would thus "age adjust" to a standard population. The choice of a standard population is usually a matter of tradition and convenience. The state is commonly the standard population when rates for counties are adjusted. The reasons are: (1) it is traditional to ask how a county's crude rate might be transformed if the county had the same population structure as the state, and (2) the state is a natural standard for counties.

What is the intuitive meaning of the rate adjustment formula? Consider the data in Example 1 where the study population is Hope County and the numbers are deaths in age subsets. We see, first, that each age-specific death rate in Hope County is multiplied by the size of the corresponding North Carolina category. Thus the first specific county rate of 100 per 100,000, which is a force of mortality, is applied to the state's population of 1,000,000 in the first stratum; the product is an adjusted number of deaths for the first stratum. Similar products are obtained for all the strata. Second, the sum of the adjusted numbers is divided by the state's population, 4,500,000 in Example 1.